Formation of Crenulated Clinoforms on Continental Shelves

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Grant Number: N00014-02-1-0252
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LONG-TERM GOAL

The long-term goal of this research effort is to improve understanding of sediment transport in a region of crenulated clinoform development on a shelf adjacent to a mountainous coast drained by rivers with episodes of high discharge.

OBJECTIVES

Our principal objective is to establish relationships between active sediment dynamics, cross-shelf transport and accumulation of sediment, and preservation of the stratigraphic record in the crenulated clinoforms that characterize large portions of the late Holocene prograding mud wedge in the Apennine shelf. Several specific objectives are being pursued: (1) identify the principal transport mechanisms acting in the topset and foreset region of a crenulated clinoform, (2) determine if, at present, seabed crenulations can be created and/or maintained by a specific sediment transport process, (3) provide information on the relative importance of gravity-driven flows versus current-driven sediment transport in the formation of clinoforms along the Apennine shelf, and (4) evaluate the role of internal waves in transporting sediment and inducing the formation of crenulated clinoforms.

APPROACH

The proposed approach will consist in measuring sediment transport process across a crenulated clinoform by means of deployments of a boundary-layer tripod in 20 m water depth and a mooring in 45 m water depth, off the Pescara River mouth. Another tripod provided by Dr. Andrea Ogston (U. of Washington) will be deployed in the topset region of the crenulated clinoform in 12-m water depth. The boundary-layer tripod will be equipped with a pressure sensor, three electromagnetic current meters and three optical backscatter sensors. Additionally, an Aanderaa RCM-9 current meter, equipped with turbidity, pressure, temperature and conductivity sensors will be placed at the tripod frame. The mooring line will be equipped with two RCM-9 current meters placed at 1 meter above the seabed and at 20-m water depth, in intermediate waters. Thermistors provided by Dr. Dave Cacchione (Coastal & Marine Environments) will be mounted on the mooring line at numerous heights above the seabed to asses the presence of internal waves. A schematic design of the distribution of instruments is illustrated in Figure 1. Observations will take place from late October 02 to early May 03 in two consecutive three-month deployments, following the EuroSTRATAFORM timeline plan for the Apennine field study. Instruments will be retrieved and re-deployed in early February 03.

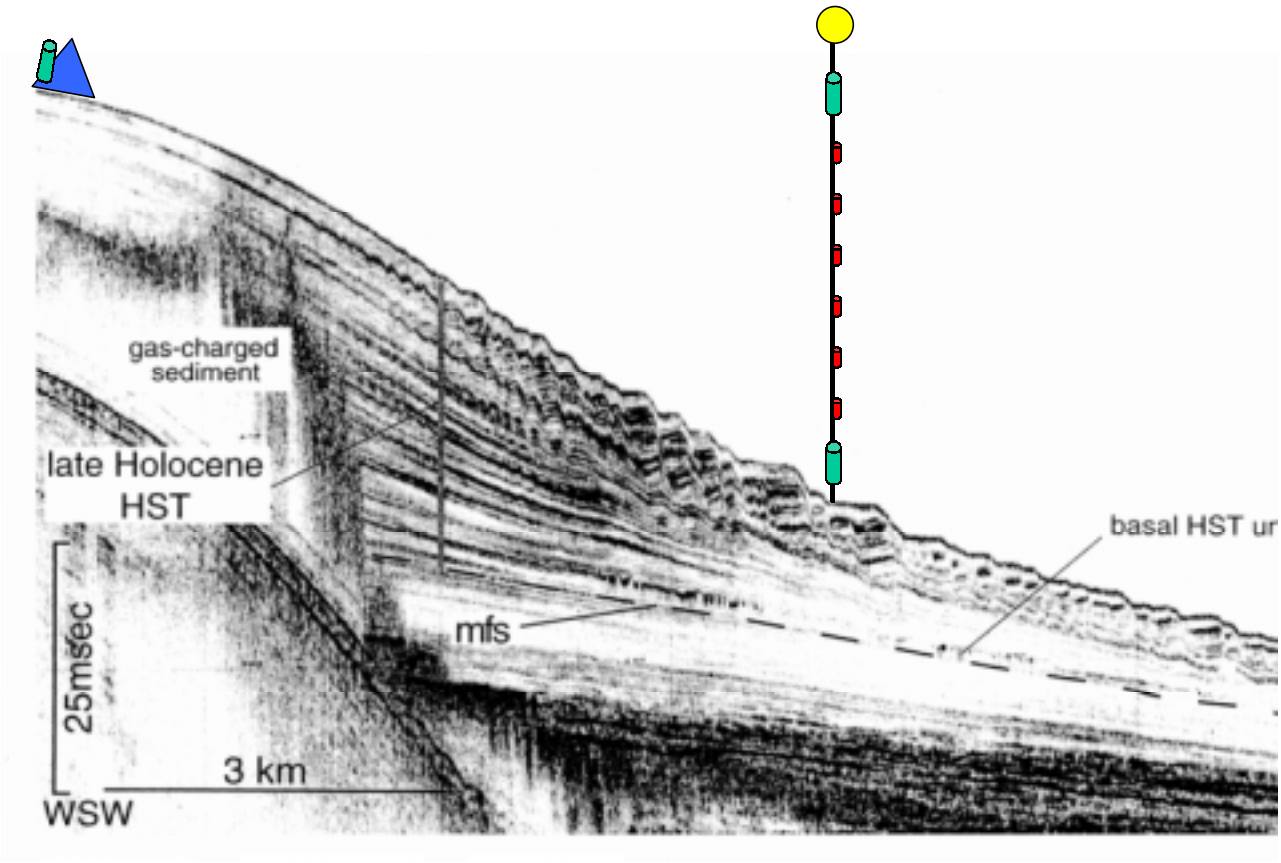

Figure 1. Instruments distribution combined with a chirp sonar profile from the study area showing a crenulated clinoform (modified from Correggiari et al., 2001). The blue triangle corresponds to the tripod position, RCM-9 current meters (in green) will be placed at the tripod site and in the mooring line, close to the seabed and at intermediate waters. Thersmistors (in red) will be mounted on the mooring at numerous heights above the seabed.

WORK COMPLETED

FY 02 was intended to be a preparation year for the upcoming observational effort beginning in late October 02. However, during this year I participated in an oceanographic cruise onboard the R/V Urania in April 02, in which, sediment coring and hydrographic surveys were conducted to characterize the entire EuroSTRATAFORM study area in the Adriatic Sea. Based in the observations obtained in that cruise, in June 02 I attended to a planning meeting in Seattle, in conjunction with other researchers involved in the Adriatic study, to design the best strategy for tripod and mooring deployments in order to accomplish the general objectives proposed in this program. Recently, in September 02, I attended the kickoff meeting of EuroSTRATAFORM in Winchester, together with all ONR and EU funded researchers.

RESULTS

No results yet.

IMPACT/APPLICATION

Sea-floor crenulations of complex and uncertain origin characterize large portions of mud-dominated continental slopes and prograding mud wedges around the world. The observed sediment transport processes observed in the Apennine shelf will provide key insight to understand the formation of crenulations in other continental margins.

TRANSITIONS

None.

RELATED PROJECTS

EU-EuroSTRATAFORM (http://www.soc.soton.ac.uk/CHD/EUROSTRATAFORM/index.html). In addition, this observational effort will be a joint effort with other ONR funded researchers, Dr. Andrea Ogston (UW), Dr. Dave Cacchione (CME) and Dr. Charles Nittrouer (UW), as well as personnel at the Instituto di Geologia Marina (CNR) in Bologna, Italy (Dr. Fabio Trincardi and Dr. Anna Correggiari).

REFERENCES

Correggiari, A., Trincardi, F., Langone, L., Roveri, M., 2001. Styles of failure in late Holocene highstand prodelta wedges on the Adriatic shelf. Journal of Sedimentary Research, 71, 218-236.

PUBLICATIONS

None

PATENTS

None